NOTE: This user's guide is adapted to software version v.0.0.17of TFF 310 CI dated 11/04/2011.
For future software updates, you can download the user's guide from the following website: http://www.ftemaximal.com/

Chapter 1. Installation.

1.1. Safety Measures

1.- Never place the device next to hot sources.
2.- Never undergo the device to temperatures that exceed its level of operation.
3.- Never expose the device to leakings nor spatterings.
4.- Never place objects that contain liquids over the device.
5.- Respect the ventilation slots of the device, do not cover them with any kind of object.
6.- The space around the device must be free of objects, in a minimum radius of 40cm.
7.- Avoid locations with possibilities of spilling liquids on the inside of the device, and with important changes of temperature.
8.- Never open the device by yourself due to electric risk. In case of problems, go always to qualified technicians
9.- Never, under no circumstances, open the device when connected to the electrical net..
10.- During the handling it is better to disconnect the device from the electrical net.
11.- Obey the electricity security rules during the assembling. Use materials that obey the current law.
12.- The connecting plug must be accessible in a fast and simple way to have a fast disconnection.
13.- Never touch the plug with wet hands. Also, disconnect always the device before handling the connections.
14.- Never put any heavy object over the device, since it could get damaged.
15.- If the device is going to remain some time without use, it is recommendable to disconnect it from the electrical net.
16.- The repairmen and the maintenance of the device must be done by TV and radio specialised technicians.

1.2. Box content

Quick installation guide

2 x Bridge F male – F male

DC Cable

TFF 310

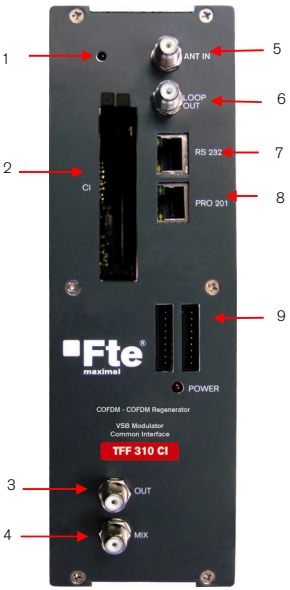
Cable 12 cm PIN to PIN RJ45 – RJ45

Stopper

1.3. Description and connections

The module TFF 310 CI is used for the reception of free channels that obey the DVB-T standards.
Each module allows the reception of a complete multiplex in DVB-T (COFDM), and its subsequent regeneration in a new multiplex. Besides, it offers the possibility of selecting the services that you wish to add in the new multiplex.
A feature of this equipment is its modulator in Vestigial Side Band (or VSB). This modulation can be used to distribute adjacent channels in one distribution without any intermodulation problem.
Each module has one Loop connector to cascade several modules at input and a Mix connector to do same in output channels.The output channel is selectable between C2 and C69.
All parameters are programmed by the means of PRO 201 or the EVO or MINI series of field strength meter, and they are monitored in the display of programmer or in the 5" TFT screen of field strength meter.
TFF 310 CI has two Common Interface slots.

TFF 310 CI



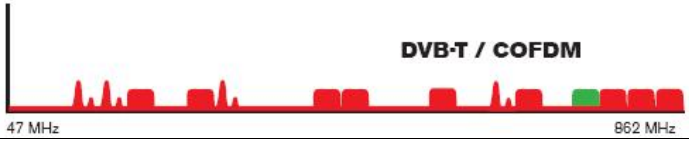
1. Two-colored led*: It indicates the different states of the device.
2. CI: Common Interface.
3. OUT: This connector supplies the modulated channel according to the selected standard in the module and mixes it with all the signals that it receives throught the MIX connector
4. MIX: Input of mixing of the module.
5. ANT IN: To connect to the antenna or to the LOOP OUT output of the previous module
6. LOOP OUT: To connect to the ANT IN input of the next module.
7. RS 232: Ethernet connector to cascade modules with the RCM 310 telecontrol unit with the RJ45/RJ45 cable provided.
8. PRO 201: Ethernet connector to make the programming with the programmer.
9. DC connectors: It has two connectors for input/output.

***States of two-colored leds**

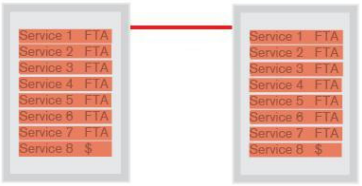
1. Initialization mode
   - Green: main application charged.
   - Blinking Green: Completing the initial sequence, at the moment when the module gets initialized, the led will turn into one of the states the operating mode.
   - Red: Phase of initializing the module.
2. Operative Mode
   - Green: The system is working properly.
   - Orange: At least one critical event has been recorded in the module. The led will only change into green when the registration of events has been read by the programmer.
   - Red: Error or alert detected in the running of the device, the led will be on only as long as the error/alert is present. Once the error or the alert disappears, the led will change into orange because the error/alert is stored in the registration of events.
3. Programming mode
   - When the module detects an external programmer, the led will blink in the next sequence: green-orange-red.
   - Once you leave the programming mode, the led will turn into the corresponding operating mode.

Stages of TFF 310 CI regenerator

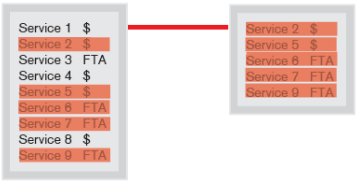
Input



Reception of a terrestrial multiplex with a typical error rate in the output of the antenna.



Case 1: Regeneration



Case 2: Filtering + Regeneration

Signal regeneration and possibility of making a services filtering.
If the multiplex has encoded channels, in order to distribute them freely you have to install the PCMCIA + subscriber card in the Common Interface slot.

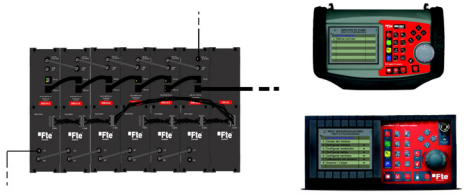
Out

Configuration of the channel and output parameters of a multiplex with a corrected error rate.

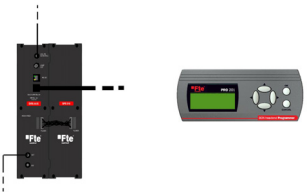
1.4. Programming

TFF 310 CI has two ethernet connectors. In order to make the programming of the module you have to connect the corresponding programmer to PRO 201 connector.
You can make the programming through the PRO 201 programmer and also through the mediaMAX EVO and mediaMAX MINI field strength meter.

1.4.1. Programming modes



With mediaMAX EVO / mediaMAX MINI field strength meter you can carry out the programming of all the modules consecutively as long as they are interconnected with each other through the RJ-45 cable supplied with each unit.



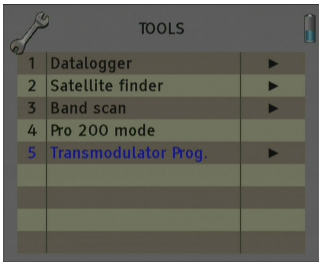
Through PRO 201, the programming is made module by module.

1.4.2. Programming

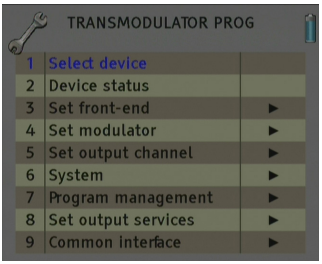
Below you will find the steps to follow in order to make the programming both from corresponding EVO and MINI field strength meter as well as from PRO 201.

mediaMAX EVO / mediaMAX MINI

In order to start programming the TFF 310 CI regenerator, you will have to go to "Tools" option through the key 8 of your field strength meter and to select the "Transmodulator Prog." option.

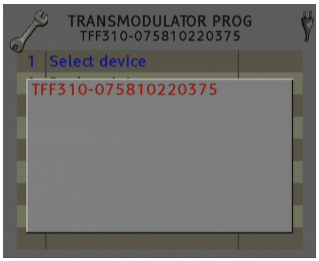


Then, it will proceed to recognize the module and to show the main menu. In the "Transmodulator Prog." are shown the different configuration options that this tool offers:

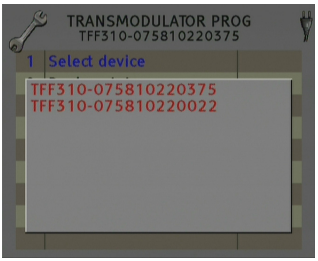


1. Select Device

The field strength meter allows making the programming of one or several regenerator/s and/or transmodulator/s from only one module.



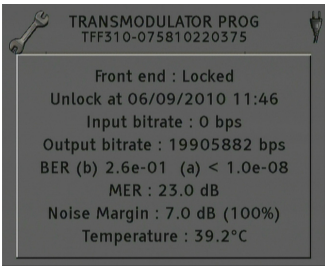
Without interconnection of modules.
An only module connected



Interconnection of several modules, you can select which module you wish to program.

2. Device Status

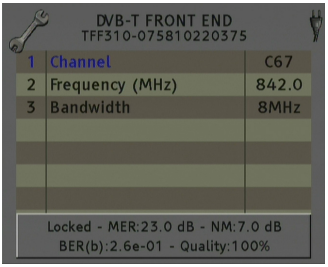
In the option "Device Status" are specified the main parameters of the module at this moment.


TRANSMODULATOR PROG
TFF310-075810220375
Front end : Locked
Unlock at 06/09/2010 11:46
Input bitrate : 0 bps
Output bitrate : 19905882 bps
BER (b) 2.6e-01 (a) < 1.0e-08
MER : 23.0 dB
Noise Margin : 7.0 dB (100%)
Temperature : 39.2°C

- Front End: It indicates whether the module is hooked or without signal.
- Input bit rate: Transfers of data in the terrestrial tuner input.
- Output bit rate: Transfer of data in the module output.
- BER before and after Viterbi: It indicates the error rate of bits of the input signal before and after the correction produced by Viterbi algorithm.
- MER: Parameter that indicates the quality of the input modulated digital signal, expressed in dB.
- Noise Margin: It indicates the difference between the value of current C/N and the value of C/N at the point of pixilation of the signal, that is, the quantity of dBs of C/N measure that are needed to lose the input signal.
-Temperature: It indicates the current temperature of the module in ºC.

3. Set Front End

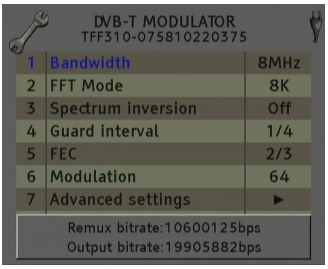
In this option you will be able to configure the input parameters of the terrestrial signal:



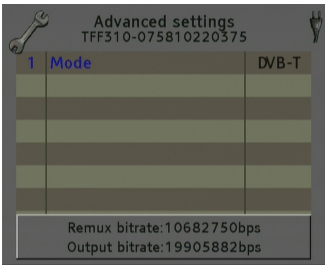
- Channel: Input channel of the multiplex that you wish to tune. When you select the output channel, the field "Frequency (MHz)" will be modified automatically, adapting itself to the selected channel. Options: C5-C12/C21-C69.
- Frequency (MHz): Input frequency of the multiplex that you wish to tune. When you modify this field, the field "Channel" will be also modified, indicating the channel equivalent to the selected frequency in the case that this frequency corresponds to the frequency of a channel. Options: 170-230 / 470-862 MHz.
- Bandwidth: Selection of the input signal Bandwidth: 8 MHz, 7 MHz and 6 MHz.

4. Modulator Set Up

This option allows configuring the DVB-T/DVB-H modulator of the device.



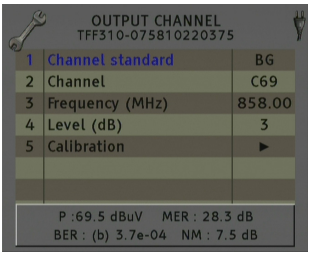
- Bandwidth: Selection of the Bandwidth of the modulated signal: 8 MHz, 7 MHz, 6 MHz and 5MHz. The 5 MHz option is only supported by DVB-H standard.
- FFT Mode: Selection of the number of carriers used in the modulation. Options: 8K, 4K and 2k. The 4k option is only supported by DVB-H standard.
-Spectrum inversion: Activate or deactivate the spectrum reverse in the modulation.
- Guard interval: Allows selecting the guard interval of the modulation:1/4, 1/8, 1/16 and 1/32.
- FEC: Indicates the relationship between the redundant bits and the transmitted information bits:1/2, 2/3, 3/4, 5/6 y 7/8. For example, in a FEC = 2/3 relation we will find 2 information bits and 1 redundant bit.
- Modulation: Output modulation format: 4 (QPSK), 16 (16 QAM), 64 (64 QAM).
- Advanced settings:
    - Mode: Selection of the modulation standard: DVB-T and DVB-H.



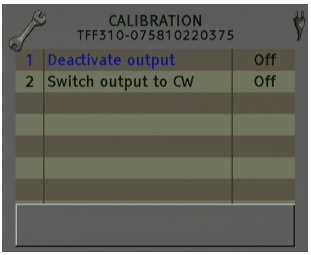
Note: The output useful bits rate will depends on the following parameters: Bandwidth, guard interval, FEC codification and modulation. In the *Attachment I* you will find all the information related to the resulting useful bit rate in each configuration.

5. Set Output channel

In this option you can configure the different parameters of the cable signal.

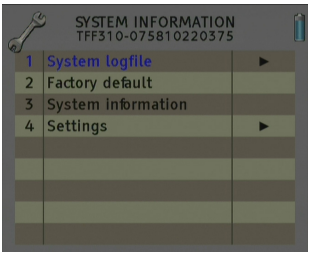

OUTPUT CHANNEL
TFF310-075810220375
1 Channel standard BG
2 Channel C69
3 Frequency (MHz) 858.00
4 Level (dB) 3
5 Calibration ►
P :69.5 dBuV MER : 28.3 dB
BER : (b) 3.7e-04 NM : 7.5 dB

- Channel standard: It allows you to select the channelling of the cable signal standards. Options: BG, BG, PAL BG IT, 11, M NTSC, PAL M, PAL N, PAL DK , PAL I, BB_AU, DK PAL, L PAL.
- Channel: Output channel of the cable modulation. When you select the output channel, the field "Frequency (MHz)" will be modified automatically, adapting itself to the selected channel. Options: C2-C69.
- Frequency (MHz): Output frequency of cable modulation. When you modify this field, the field "Channel" will be also modified, indicating the channel equivalent to the selected frequency in the case that this frequency corresponds to the frequency of a channel. Options: 47-862 MHz.
- Level: Regulation of the output level of the modulated signal. Options: 0-15dB.
- Calibration: Allows the realization of two tests in order to verify the correct running of the device.
    - Deactivate output: It allows activating or deactivating the ouput of regenerator.
    - Switch output to CW: It allows activating or deactivating the DVB-T / DVB-H modulation, allowing visualizing the carrier without modulation in the selected frequency.

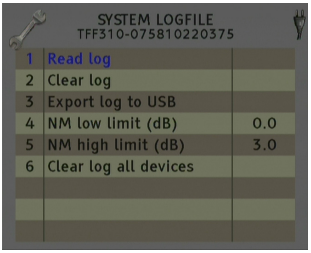


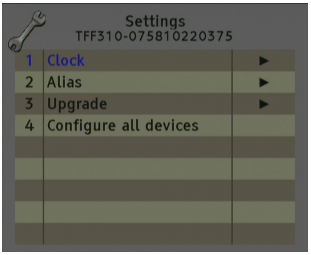
6. System

This option provides information of the regenerator.

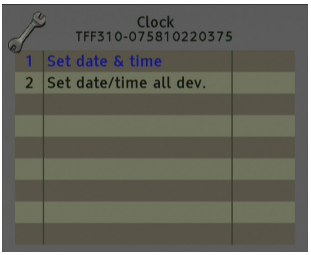


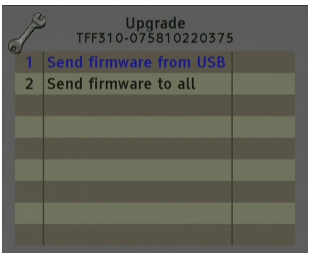
- System logfile: In this field are indicated the registered events in the module.
    - Read log: It allows reading the registered events in the module.
    - Clear log: It allows deleting all events stored until this moment.
    - Export log to USB: It allows you to export all events registered to the connected USB device.
    - NM low Limit (dB): An event of error will be recorded when the value of Noise Margin is lower than the set value.
    - NM hight limit (dB): Once the event of error is recorded (Noise Margin < Limit Lower NM), this will be Noise Margin value that will have to be exceed so the module stops being in error.
    - Clear log all devices. It allows deleting the events report of all the interconnected modules.
- Factory default: This option restores the values by default of the regenerator.
- System information: It allows you to visualize the basic information of the module: model, no of series, firmware version, etc.
- Settings: This option allows saving and loading the configuration of the module, carrying out firmware update or making an adjustment of the time and date of the module.
    - Clock:
        - Set Date and time: Setting of the date and time of transmodulator. It is appropriate to maintain these parameters set in order to have the registration of errors linked to the current time and date.
        - Set date/time all devices: Loading the current date and time of the module in the rest of interconnected modules.
    - Alias:
        - Write alias: It allows you to assign a name/alias to the module you are programming. Option only available when the Alias Auto option is configures as "none" (manual mode).
        - Auto Alias: It allows configuring the name/alias of the modules automatically. Options: Channel, Frequency, Service, None.
    - Upgrade:
        - Send Firmware from USB: It allows carrying out the firmware update from the USB device.
        - Send firmware to all: It allows carrying out the update of all the modules that are interconnected at the same time.

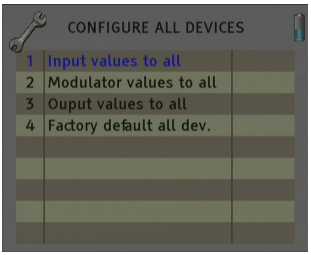




- Configure all devices:
    - Input values to all devices: It allows copying the current input configuration in all the interconnected modules.
    - Modulator values to all devices: It allows copying the configuration of the current modulator in all the interconnected modules.
    - Output values to all devices: It allows copying the current output configuration in all the interconnected modules.
    - Factory default to all devices: It allows making values by default to all the interconnected modules.

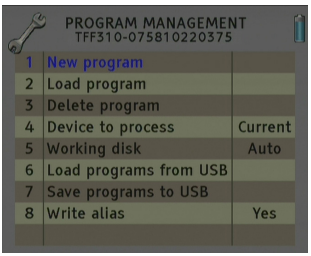






7. Program management

- New program: This option allows creating a program with the current configuration of a module or group of modules.
- Load program: It allows loading a previously created program on a module or group of modules.
- Delete program: It allows deleting a program.
- Device to process:
    - Current: The creation or loading of a program will be applied only in the module that is currently connected.
    - All: The creation or loading of a program will be applied to the whole group of connected modules.



- Working disk: With this option we have the possibility of choosing if we want to work into the internal disk or in the external storage device USB 2.0.

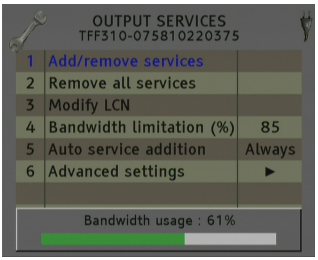
  Once the option is selected, a dialog box will appear and we will be able to choose among three different options.

  - Auto: The Meter decides where the data will be stored. If there is external memory connected, the Meter will store the data in it. If not, it will use the internal memory.
  - USB: The Meter always will try to use the external memory connected to the USB port. If this memory has not been connected an error message will be shown, reminding that there was an error storing the data and it will be not stored.
  - Internal: Always the internal memory is used to store the data.

- Load programs from USB: This option allows importing programs from a USB memory to the field strength meter. Before using this option you must connect a USB memory.
- Save programs to USB: This option allows copying the programs stored in the external USB 2.0 storage device.
- Write Alias: It allows saving the alias of the module in the program. Options: Yes/No

8. Set Output Services

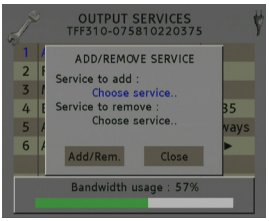
This option allows making the selection of the services that you wish to include in the output multiplex.



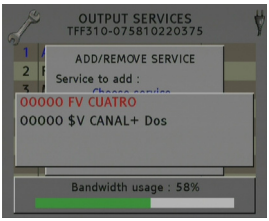
- Add/Remove services: It allows adding the services to the multiplex and also removing the ones previously included. The lower bar informs about the available space in the output multiplex. As you add more services, the space available will decrease.

Once you have tuned a multiplex in the "Input Set Up" section and you have selected the DVB-T/DVB-H modulator configuration in the "Modulator Set Up" section, you can make the assignment of the services that are going to be included in the output multiplex "Adding/Removing services".

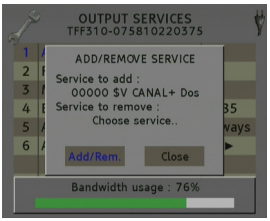
Adding services:



1. Select "Service to add" option

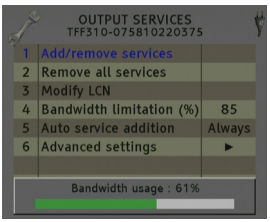


2. Select one of the multiplex services you want to add.

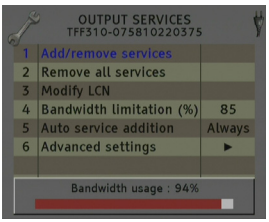


3. Once you have chosen the service, select the "Add/Remove" button to include the service in the multiplex.

Note: It is not recommended to exceed the 85% of the maximum capacity of the multiplex due to the possible variability of the bits rate of the inputs services.

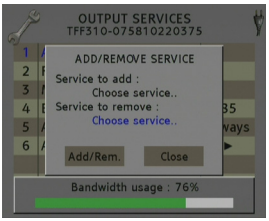


Recomendad capacity
(lower to 85%)

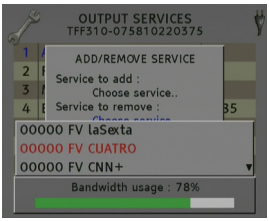


Excessive capacity
It is recommended to remove services

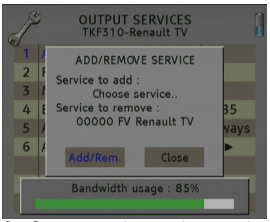
Removing services:



1. Select the "Service to remove" option.

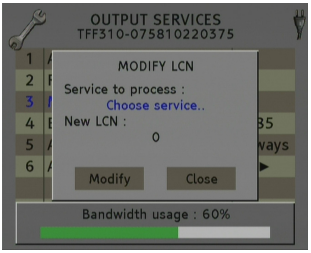


2. Select one of the multiplex services you want to remove.



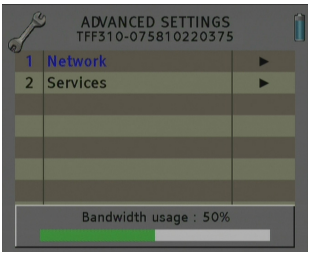
3. Once you have chosen the service, select the "Add/Remove" button to remove the service in the multiplex.

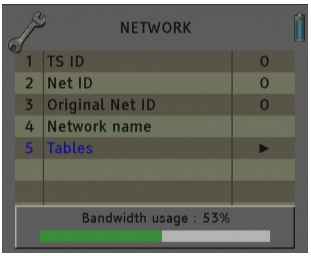
- Remove all services: It allows removing all the services included in the multiplex.
- Modify LCN: The LNC function allows assigning automatically a predetermined position to each one of the services of the multiplex. This function will allow the users who have a receiver with LNC support to make the ordination of channels automatically.



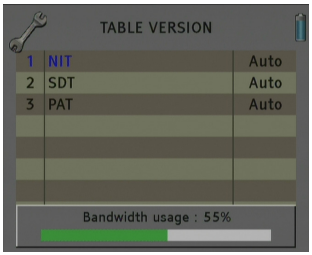
Note: If in the existing installation there are already services that have LNC system, you will have to configure the position of the module services in order to avoid conflicts with other net services.

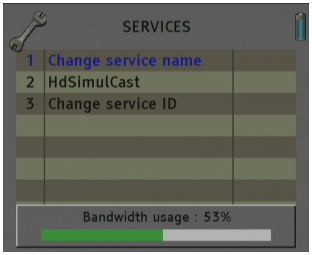
- Bandwith limitation: It allows selecting the % of the capacity of the output channel.
- Auto service addition:
  - On: It selects the services automatically when an input carrier is tuned and when the list of selected services is empty. The receiver will have this state by default.
  - Always: It selects the services automatically every time a new input carrier is tuned. This state is only recommended to be used for making test in the module.
  - Off: The automatic mode is deactivated; the services have to be manually selected.
- Advanced settings:
  - Network: It allows making the adjustment of the identification parameters of the multiplex.
    - TS ID: Transport Stream identification value. It is recommended to configure a value different from TS ID for each one of the output multiplex configured.
    - Net ID: Net identification value
    - Original Net ID: Original net identification value
    - Network Name: Name associated with the net.
    - Tables: It allows modifying the value of the following information tables of the DVB, NIT, SDT and PAT services.

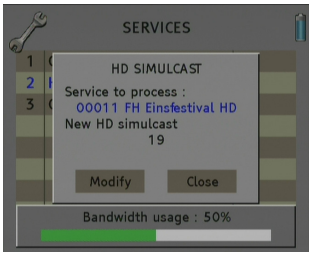




- Services:
  - Change service name: It allows changing the name of the service manually. In order to do so, please choose the service in the first line and then write the new name in the second line. Then you have to press “modify” in order to save the changes.
  - HDSimulCast: In cases where we receive in an installation the same channel in high definition and in standard definition, the HD Simualcast function allows to exchange the position of the LNC of both channels. If the user has a device compatible to HD Simulcast and the module has been correctly configured, when tuning the standard definition channel, it will move to its position in high definition automatically. This option allows modifying manually the position of the LNC, exchanging the standard position into the high definition position. In the first line you have to select the high definition service and in the second line you have to select the same service but in standard definition.
  - Change in Service ID: From this position you can change the PID Number of the chosen service.







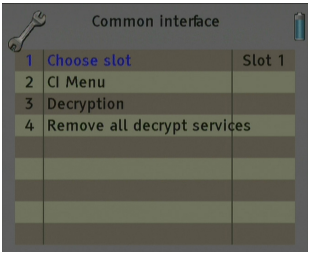
Next it is attached the identification table (NID/ONID) of the main satellites. You will be able to find more information in the law ETSI TR 101 162 v1.2.1.

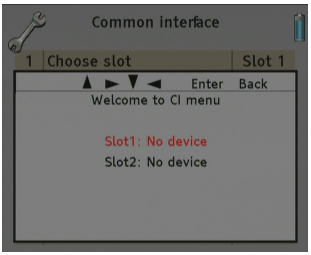
Satellite	Net ID	Original Net ID	Description
Hotbird 13ºE (Eutelsat 13ºE)	318	318	Eutelsat 13ºE System
Astra 19.2ºE	1	1	Astra Satellite Network 19,2ºE
Astra 23ºE	3-25	3-25	Astra n (n=1-23)
Astra 28,2ºE	2	2	Astra Satellite Network 28,2ºE
Nilesat 7ºW	2048	2048	Nilesat 101
Hispasat 30ºW	33	33	Hispasat Network 1

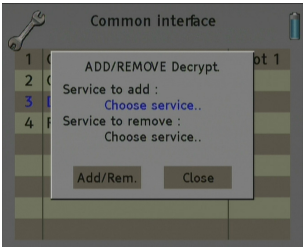
9. Common Interface

This option allows checking the information and configuring the parameters regarding the conditional access.

- Selecting Slot: It selects the Slot where the CAM for decoding the services is inserted.
- CI Menu: From here you can reach the menu of the card inserted in the CAM.
- Decrypted: From this option you can add or remove manually the services that are being decoded by the card.
- Deactivating all decrypted: From this option you can remove all the services that are decoding the conditional access card.





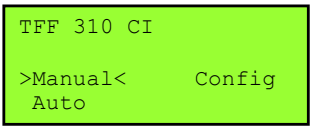


PRO 201

Note: From PRO 201 programmer you can only carry out the programming of a single module, in order to carry out the programming of several modules at the same time you have to use a mediaMAX EVO or mediaMAX MINI series field strength meter.

When you connect the PRO 201 programmer, it will proceed to recognize the module and to show the main menu.
In the main menu are shown the different options for configuring the regenerator.

We have to use the "Up" and "Down" buttons of the keyboard in order to move to the different options, and to get into the submenus we have to press "OK" button.

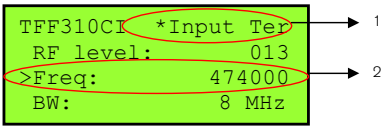


1. Manual

Inside the "manual" menu there are specified the different options for setting up the input, output and modulation parameters.

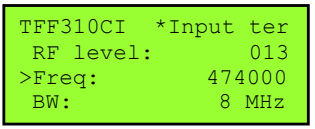
1. This field shows the type of parameter that is selected at the moment. Options: Input Terr, Out Terr, Out TV.

2. This field shows the parameter that is selected. In order to move around the different options we have to use the "Up" and "Down" buttons of the keyboard. Click on OK to edit the selected parameter and Right/Left for changing it. Once it is configured press Cancel.



Terrestrial input (Input Ter)

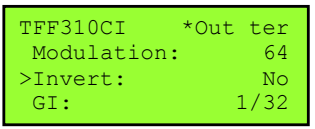
In this option you will be able to configure the input parameters of the terrestrial signal:



- Freq. (MHz): Input frequency of the multiplex that you wish to tune. In order to introduce the frequency, press the "OK" button and the cursor will be placed over the frequency. With the keys of the cursor, we can move through all the digits and change the values. Press "OK" in order to save the value. Options: 170-230 / 470-862 MHz.
- BW (Bandwidth): Selection of the input signal Bandwidth: 8 MHz, 7 MHz and 6 MHz.

Terrestrial modulation (Out Terr)

These options allow configuring the DVB-T/DVB-H modulator of the device.

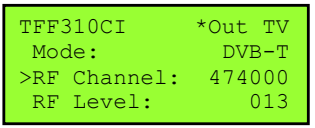


- Modulation: Output modulation format: 4 (QPSK), 16 (16 QAM), 64 (64 QAM).
- Invert (Spectrum inversion): Activate or deactivate the spectrum reverse in the modulation.
- GI (Guard interval): Allows selecting the guard interval of the modulation: 1/4, 1/8, 1/16 and 1/32.
- BW (Bandwidth): Selection of the Bandwidth of the modulated signal: 8 MHz, 7 MHz and 6 MHz and 5MHz. The 5 MHz option is only supported by DVB-H standard.
- Tx Mode (FFT Mode): 8K, 4K and 2k. The 4k option is only supported by DVB-H standard.
- FEC: Indicates the relationship between the redundant bits and the transmitted information bits: 1/2, 2/3, 3/4, 5/6 y 7/8. For example, in a FEC = 2/3 relation we will find 2 information bits and 1 redundant bit.
- Mode: Selection of the modulation standard: DVB-T and DVB-H.

Note: The output useful bits rate will depend on the following parameters: Bandwidth, guard interval, FEC codification and modulation. In the *Attachment I* you will find all the information related to the resulting useful bit rate in each configuration.

Output configuration (Out TV)

In these options you can configure the output parameters of the terrestrial signal.



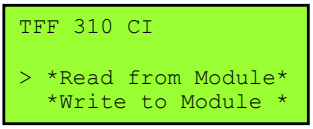
- RF Channel (MHz): Output frequency of terrestrial modulation. In order to introduce the frequency, press the "OK" button and the cursor will be placed over the frequency. With the keys of the cursor, we can move through all the digits and change the values. Press "OK" in order to save the value. Options: 47-862 MHz.
- RF Level: Regulation of the output level of the modulated signal. Options: 0-15dB.

Summary table:

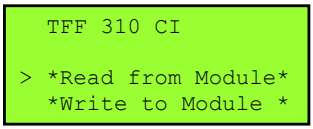
Terrestrial input	Terrestrial output	TV output
- Frequency - Bandwith (BW)	- Modulation - Invert (Spectrum Inversion) - Guard Interval (GI) - Bandwith (BW) - Tx Mode (FFT Mode) - FEC - Mode	- RF Channel - RF Level

2. Auto

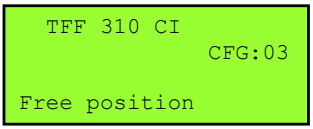
This option allows saving and loading the configuration of the module in the PRO 201 programmer.



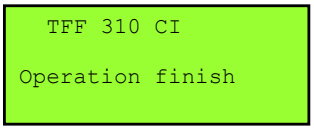
- Read from module: It stores the current configuration of the module in the memory of the programmer. The steps to make a correct reading of the headend are specified below:



1. Select the option "Read from module" through Up/Down buttons. Press OK to continue

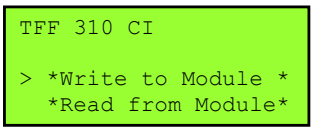


2. Select the position of "CFG" memory where you wish to save the current configuration of the module.

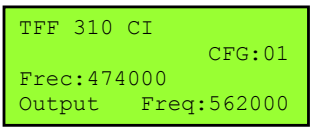


3. A window will appear and it will let you know that the reading made has been correct

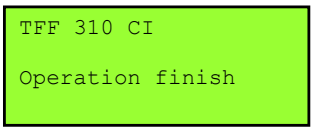
- Write to module: It loads in the module one of the configurations previously saved in the memory of the programmer. The steps to make a correct configuration of the headend are specified below:



1. Select the option "Write to module" through Up/Down buttons. Press OK to continue



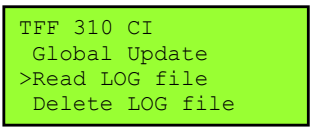
2. Select the position of the "CFG" memory that you wish to copy in the module. Please verify that the data of the selected memory correspond to the channel that you wish to copy.



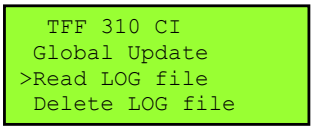
3. A window will appear and it will let you know that the configuration made has been correct

3. Config

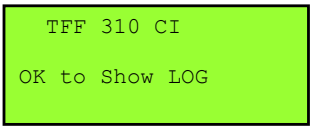
In "Config" option the information concerning the regenerator is given.



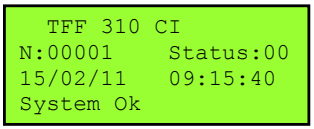
- Read log: It allows reading the registered events in the module.



1. Select the option "Read LOG file" through Up/Down buttons. Press OK to continue



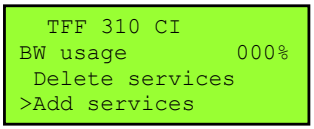
2. Press OK again to show the log file.



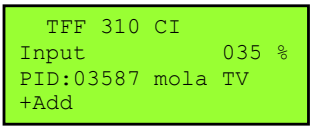
3. A new window will appear. It will show the information about the registered events in the module. Press the following keys in order to scroll up and down the screen: "up/down".

- Delete LOG file: It allows deleting all events stored until this moment.
- Factory default: This option restores the values by default of the transmodulator.
- Update FW: It allows carrying out the firmware update from the programmer.
- Output services: This option allows making the selection of the services that you wish to include in the output multiplex. Once you have tuned a multiplex and you have selected the DVB-T/DVB-H modulator configuration, you can make the assignment of the services that are going to be included in the output multiplex "Adding/Removing services".

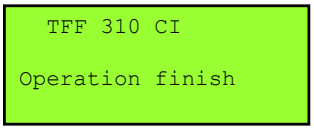
- Add Services



1. Select the option "Add services" through Up/Down buttons. Press OK to continue.

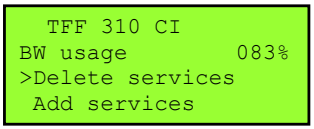


2. Select one of the multiplex services you want to add, through Left/Right keys and select the "+Add" button to include the service in the multiplex

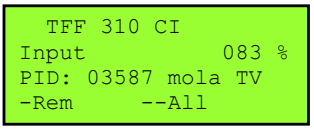


3. A window will appear and it will let you know that the operation made has been correct.

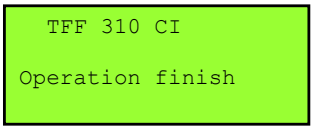
- Delete Services



1. Select the option "Delete services" through Up/Down buttons. Press OK to continue.



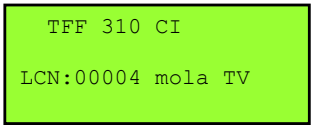
2. Select the service you want to delete with the Left/Right keys. Then press OK over "-Rem" in order to remove it, or press OK over "--All" in order to delete all the services of the multiplex.



3. A window will appear and it will let you know that the operation made has been correct.

Note: It is not recommended to exceed the 85% of the maximum capacity of the multiplex due to the possible variability of the bits rate of the inputs services.

- LCN: The LNC function allows assigning automatically a predetermined position to each one of the services of the multiplex. This function will allow the users who have a receiver with LNC support to make the ordination of channels automatically.
Select a channel through Left/Right buttons and introduce the position. Press the "OK" button and the cursor will be placed over the number. With the keys of the cursor, we can move through all the digits and change the values. Press "OK" in order to save the changes

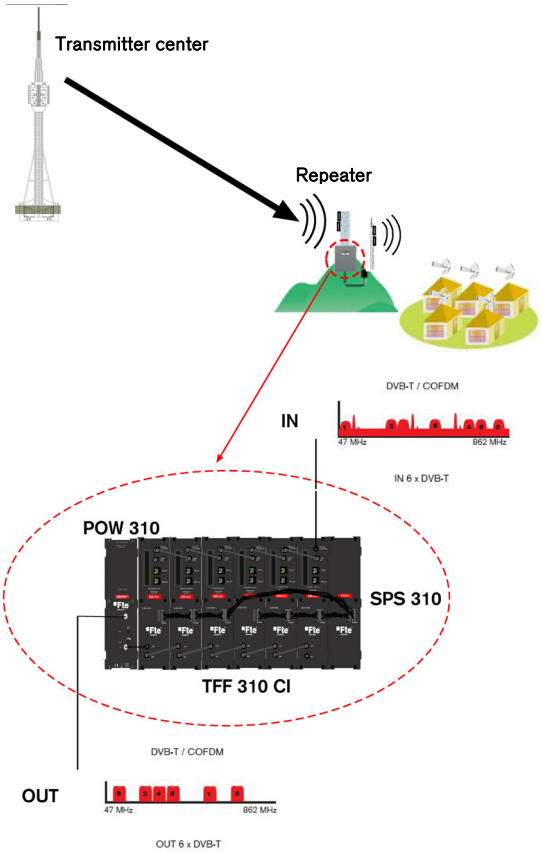


Note: If in the existing installation there are already services that have LNC system, you will have to configure the position of the module services in order to avoid conflicts with other net services.

- Decrypt services: From this option you can add or remove manually the services that are being decoded by the card:
  - Delete services
  - Add services
- Date / Hour: Setting of the date and time of transmodulator. It is appropriate to maintain these parameters set in order to have the registration of errors linked to the current time and date.
- SW version info: It allows you to visualize the basic information of the module: model, firmware version, etc.
- Global Update: It allows carrying out the update of all the modules that are interconnected at the same time.

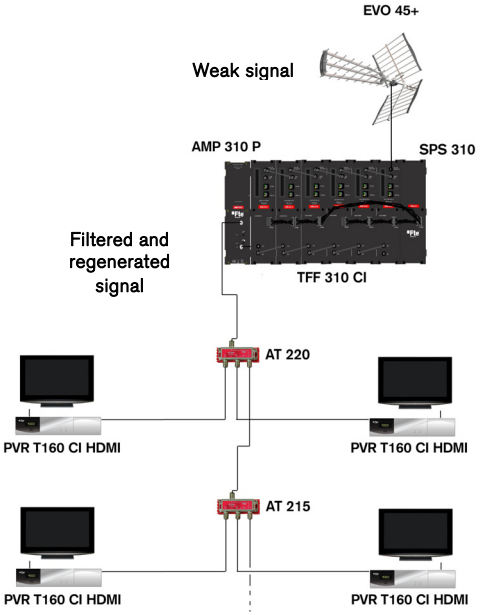
1.5. Accessories and example of installation

Example of installation 1

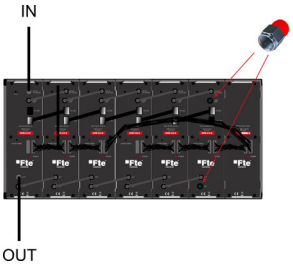


Installation of a repeater in order to regenerate the signal and give TDT coverage to a zone in shadow. The signal from the transmitter centre is received and it is injected into TFF 310 CI regenerators. These modules regenerate the signal and allow making a re-assignment of the input channels. Later, the signal goes through a power stage of POW 310 in order to get a proper output level to cover, through the corresponding antennas, the zone with small signal or without coverage.
In order to distribute the encoded channels freely you have to install the PCMCIA + subscriber card in the Common Interface slot.

Example of installation 2



Installation where we get a bad signal and with high error rates in the output of the antenna. This signal is injected in the headend formed by 6 TFF 310 CI regenerators which will allow regenerating and/or filtering the signal of 6 multiplex, so later we can amplify them through and AMP 310 P and distribute them through the installation. The distributed channel will need a terrestrial digital receiver in order to be decoded.
In order to distribute the encoded channels freely you have to install the PCMCIA + subscriber card in the Common Interface slot.



Note: In order to guarantee the right running of the different equipments of the installation, we recommend you to provide the inputs and outputs which are not used with a 75Ω load.

Accessories

Programmer
Mod. PRO 201
Code 2003123

Field strength meter
Mod.MediaMAX EVO S2
Code 3001006

Field strength meter
Mod. MediaMAX MINI S2T
Code 3001026

Power amplifier
Mod. POW 310-1
Code 2003556

Wide band amplifier 47-862MHz
Mod. AMP 310 P
Code 2003520

Terrestrial antenna
Mod. EVO 45+
Code. 9003911

Chapter 2. Technical features

Ref.	TFF 310 CI
Code	2003552
Input frequency margin	170-230 / 470-862 MHz
Input modulation	COFDM
Input level	38-88 dBuV
Imput impedance	75 Ω
Bandwidth (MHz)	DVB-T (6 - 7- 8)
Guard Interval	1/4, 1/8, 1/16, 1/32
Reception mode	DVB-T (2K, 8K)
Modulation	QPSK, 16 QAM, 64 QAM
Input connector	Female F connector
Input LOOP losses	<1 dB
Modulation Error Ratio (MER)	Typ. 38 / Min. 36
Selectable format of output modulation	DVB-T / DVB-H
Bandwidth (MHz)	DVB-T: 6/7/8 - DVB-H: 5/6/7/8
Mode	DVB-T: 2k-8k - DVB-H: 2k-4k-8k
Output channels	C2-C69
Output connectors	Female F connector
Output Level	80 dBuV
Regulation margin	15 dB
MIX Losses	<1 dB
Band spurious	-60 dBc
Programming Interface	RJ-45
Programmer	PRO 201, media Max EVO and media Max MINI
Common Interface	Yes, 2 Slots
Operating temperature	0ºC-45ºC
Consumption 5V (mA)	650
Consumption 12V (mA)	300
Consumption 24V (mA)	15
Consumption 30V (mA)	2
Dimensions	75x265x150 mm
Weight	1,4Kg

Chapter 3. Declaration of conformity

CONFORMITY DECLARATION

"WE , FTE MAXIMAL, DECLARE THAT THE PRODUCT
TFF 310 CI
IS IN CONFORMITY WITH FOLLOWING DIRECTIVES
Low Voltage Directive 2006/95/EC
EMC Directive 2004/108/EC"

If you wish a copy of the conformity declaration, please contact to the company

ATACHMENT I

Depending on the configured parameters we are going to obtain one particular channel capacity (output useful bit rate). In order to make an estimation of this output bits rate, we have to take into account the following parameters:

Symbol duration (Ts)

For signals of 8 MHz

Mode	8K (6817 carrier)				4K (3409 carrier)				2K (1705 carrier)			
Symbol duration	896 us				448 us				224 us			
Guard Interval	1/4	1/8	1/4	1/8	1/4	1/8	1/16	1/32	1/4	1/8	1/16	1/32
Duration	224us	112us	56us	28us	112us	56us	28us	14us	56us	28us	14us	7us

For signals of 7 MHz

Mode	8K (6817 carrier)				4K (3409 carrier)				2K (1705 carrier)			
Symbol duration	1024 us				512 us				256 us			
Guard Interval	1/4	1/8	1/16	1/32	1/4	1/8	1/16	1/32	1/4	1/8	1/16	1/32
Duration	256us	128us	64us	32us	128us	64us	32us	16us	64us	32us	16us	8us

For signals of 6 MHz

Mode	8K (6817 carrier)				4K (3409 carrier)				2K (1705 carrier)			
Symbol duration	1194,6 us				597.3 us				298,6 us			
Guard Interval	1/4	1/8	1/16	1/32	1/4	1/8	1/16	1/32	1/4	1/8	1/16	1/32
Duration	298,7us	149,3us	74,7us	37,3us	149,3us	74,6us	37,3us	18,6us	74,6us	37,3us	18,6us	9,3us

For signals of 5 MHz

Modo	8K (6817 carrier)				4K (3409 carrier)				2K (1705 carrier)			
Symbol duration	1433,6 us				597.3 us				298,6 us			
Guard Interval	1/4	1/8	1/16	1/32	1/4	1/8	1/16	1/32	1/4	1/8	1/16	1/32
Duration	358,4us	179,2us	89,6us	44,8us	179,2us	89,6us	44,8us	22,4us	89,6us	44,8us	22,4us	11,2us

Modulation

Modulation	QPSK	16 QAM	64 QAM
Number of bits per symbol	2	4	6

FFT Mode

FFT Mode	8K	4K	2K
Data carriers	6048	3024	1512
Total carriers	6817	3409	1705

Bits rate calculation (total)

$$Tb_{total} = fs \cdot b \cdot L$$

Where:
Fs = Symbols frequency (symbols/sec) fs=1/Ts
Ts = Symbol duration (Symbol Time + Guard Interval time)
b = Number of bits per symbol (depending on the modulation)
L = Number of data carriers (depending of FFT mode)

Bits rate calculation (useful)

$$Tb_{useful} = Tb_{total} \cdot Codif._{FEC} \cdot Codif_{\text{Reed}-Salomon}$$

FEC Cod. = FEC Codification (1/2, 2/3, 3/4, 5/6, 7/8)
Reed-Salomon Cod. = Codification made by the means of Reed Salomón algorithym (188/204)

Case study example

For example, in the case of a DVB-T transmission in Spain the configured parameters would be the following: 8k mode, 2/3 FEC, ¼ guard intervals, 64QAM constellation, for an 8 MHz channel and using the previous formula you will get the following channel useful capacity:

$$Tb_{useful} = 19.905 Mbps$$

Note: As you select a configuration with a higher output channel capacity, the protection grade against mistakes gets proportionally decreased.

Next it is shown the channel capacity for systems without hierarchy in all the cases of constellation, guard interval and codification relation, for transmissions of 8MHz, 7MHz, 6MHz y 5MHz(DVB-H).
The useful capacity channel is identical for modes 2k, 4k(DVB-H) and 8k.

Useful channel capacity (8 MHz)

Modulation	FEC codification	Guad Interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	4.976	5.529	5.855	6.032
	2/3	6.635	7.373	7.806	8.043
	3/4	7.465	8.294	8.782	9.048
	5/6	8.294	9.216	9.758	10.053
	7/8	8.709	9.676	10.246	10.556
16-QAM	1/2	9.953	11.059	11.709	12.064
	2/3	13.271	14.745	15.612	16.086
	3/4	14.929	16.588	17.564	18.096
	5/6	16.588	18.431	19.516	20.107
	7/8	17.418	19.353	20.491	21.112
64-QAM	1/2	14.929	16.588	17.564	18.096
	2/3	19.906	22.118	23.419	24.128
	3/4	22.394	24.882	26.346	27.144
	5/6	24.882	27.647	29.273	30.16
	7/8	26.126	29.029	30.737	31.668

Useful channel capacity (7 MHz)

Modulation	FEC codification	Guad Interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	4.354	4.838	5.123	5.278
	2/3	5.806	6.451	6.83	7.037
	3/4	6.532	7.257	7.684	7.917
	5/6	7.257	8.064	8.538	8.797
	7/8	7.62	8.467	8.965	9.237
16-QAM	1/2	8.709	9.676	10.246	10.556
	2/3	11.612	12.902	13.661	14.075
	3/4	13.063	14.515	15.369	15.834
	5/6	14.515	16.127	17.076	17.594
	7/8	15.24	16.934	17.93	18.473
64-QAM	1/2	13.063	14.515	15.369	15.834
	2/3	17.418	19.353	20.491	21.112
	3/4	19.595	21.772	23.053	23.751
	5/6	21.772	24.191	25.614	26.39
	7/8	22.861	25.401	26.895	27.71

Useful channel capacity (6 MHz)

Modulation	FEC codification	Guad Interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	3.732	4.147	4.391	4.524
	2/3	4.976	5.529	5.855	6.032
	3/4	5.599	6.221	6.587	6.786
	5/6	6.221	6.912	7.318	7.54
	7/8	6.532	7.257	7.684	7.917
16-QAM	1/2	7.465	8.294	8.782	9.048
	2/3	9.953	11.059	11.709	12.064
	3/4	11.197	12.441	13.173	13.572
	5/6	12.441	13.824	14.637	15.08
	7/8	13.063	14.515	15.369	15.834
64-QAM	1/2	11.197	12.441	13.173	13.572
	2/3	14.929	16.588	17.564	18.096
	3/4	16.796	18.662	19.76	20.358
	5/6	18.662	20.735	21.955	22.62
	7/8	19.595	21.772	23.053	23.751

Useful channel capacity (5 MHz)

Modulation	Codificación FEC	Guad Interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	3.110	3.456	3.659	3.770
	2/3	4.147	4.608	4.879	5.027
	3/4	4.665	5.184	5.489	5.655
	5/6	5.184	5.760	6.099	6.283
	7/8	5.443	6.048	6.404	6.598
16-QAM	1/2	6.221	6.912	7.318	7.540
	2/3	8.294	9.216	9.758	10.053
	3/4	9.331	10.368	10.978	11.310
	5/6	10.368	11.520	12.197	12.567
	7/8	10.886	12.096	12.807	13.195
64-QAM	1/2	9.331	10.368	10.978	11.310
	2/3	12.441	13.824	14.637	15.080
	3/4	13.996	15.551	16.466	16.965
	5/6	15.551	17.279	18.296	18.850
	7/8	16.329	18.143	19.211	19.793

Note: Only aplicable for DVB-H.